

# Airbus “Less Paper in the Cockpit” Concept

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## Less Paper in the Cockpit

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Services

*A modern approach to the cockpit information management*

# Objectives

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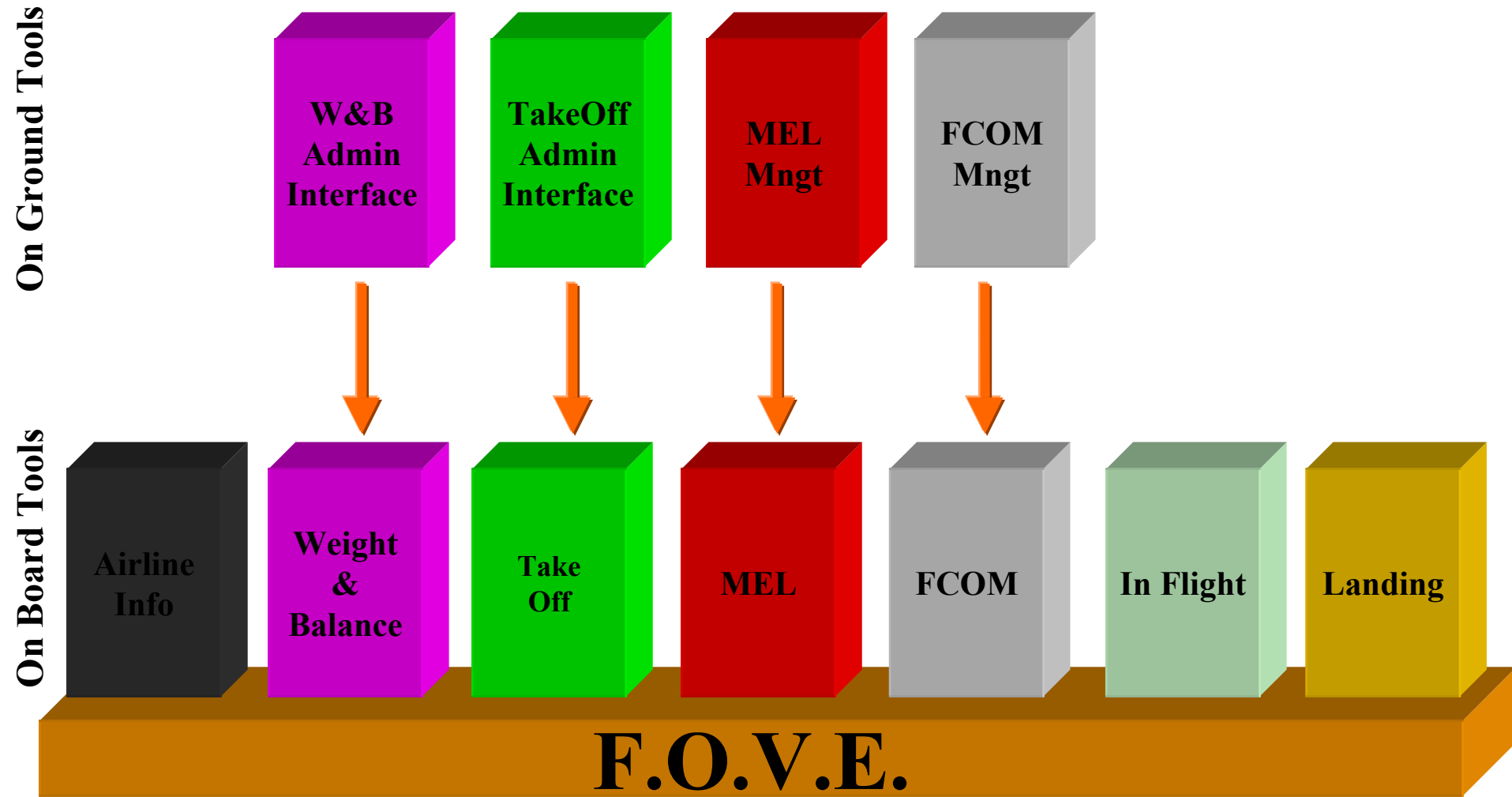
- **To find a new way how to manage operational documentation on the flight deck**
- **To provide an easy access to an increasing amount of complex information**
- **To provide an accurate computation of performance analysis - Real time computation**
- **To provide information for a given aircraft tail number**
- **To provide a unique platform for several applications**
- **To reduce revision and distribution cycle and to ensure technical data accuracy**
- **To ease and improve the updating process**

## **Flight Operations Versatile Environment**

- **aims at integrating the Performance Modules and the Flight Operations Technical Information.**
- **aims at exchanging information between the applications.**
- ***F.O.V.E. is based on an open architecture and consequently information of FOVE modules can be shared with external applications.***

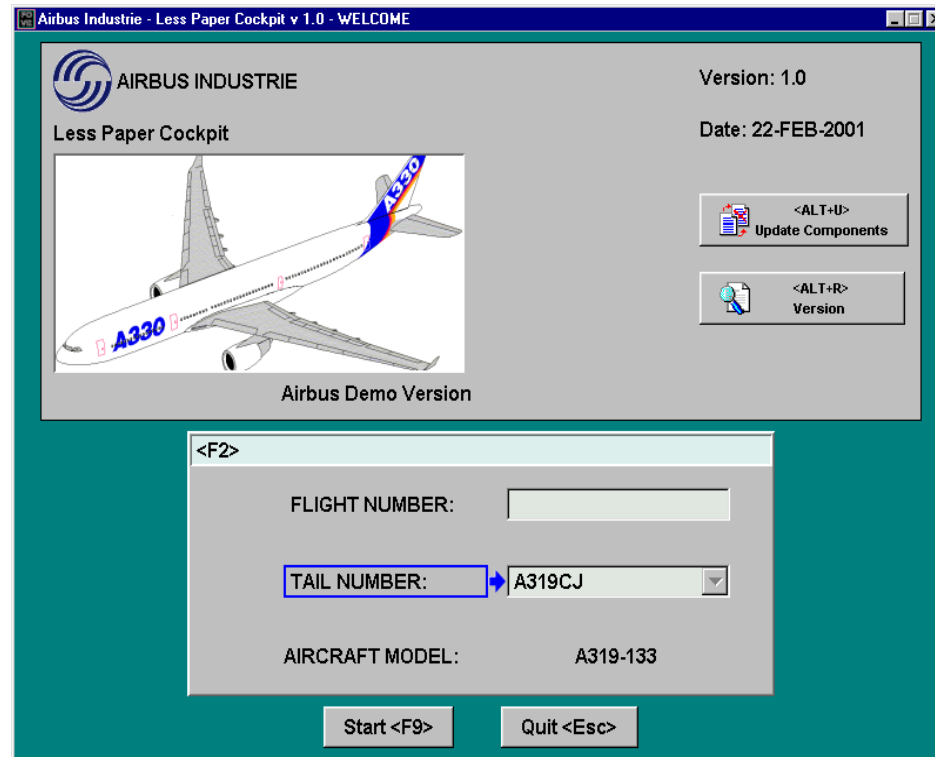


# LPC Architecture Overview





# Welcome Page



# FCOM Consultation



FCOM/OEB Consultation - Netscape

File Edit View Go Communicator Help

AIRBUS INDUSTRIE

FCOM / OEB

3.3.11 BEFORE TAKEOFF

Airbus Fcom

SABENA-S.A. BELGE  
D'EX. NAV. AERIEN

Aircraft type : A319-A320-A321 Effectivity : 970 / OO-SUA

Trace ☐ ON ☒ OFF Marks

FCOM Main Panel

3. FLIGHT OPERATIONS

3. STANDARD OPERATING PROCEDURE

1101. GENERAL INFORMATION

BEFORE TAKEOFF

**BEFORE TAKEOFF**

This Topic is relevant to the following aircraft: 970, 995, 1012, 1048, 1054, 1068, 1081, 1086, 1102, 1124, 1145, 1160, 1184, 1283, 1305, 1336, 1364, 1370, 1388, 1413, 1429

- If the brake fans are running <: :
  - BRAKE TEMP ..... CHECK
    - If brake temperature is above 150° C, delay takeoff
    - If brake temperature is below 150° C, select brake fans off

-TAKEOFF OR LINE UP CLEARANCE ..... OBTAIN

-APPROACH PATH CLEAR OF TRAFFIC ..... CHECK

-CABIN CREW ..... ADVISE

-ENG MODE selector ..... AS RQRD

Select IGN if :

- The runway has standing water.
- Heavy rain is falling.
- Heavy rain or severe turbulence is expected after takeoff.

Note : Continuous ignition is selected automatically if the ENG ANTI ICE pushbutton switch is ON.

-TCAS < Mode selector ..... TA or TA/RA

FAA recommends to select TA mode :

Document: Done



Airbus Industrie - Less Paper Cockpit V 2.2 - TAKEOFF PERFORMANCE

**AIRCRAFT**

A/C Type : A319-133

Tail Number : A319CJ

**CONDITIONS <F3>**

Wind (° / kt) : 0

OAT (°C) : 20

QNH (hPa) : 1020

TOW (kg) : 75500

CONF : OPT CONF

Air Conditioning : On

Anti ice : Off

Runway Condition : Dry

**INOP ITEM <F5>**

- NORMAL -

**Airport/RWY <F2>**

TLS LFBO BLAGNAC RWY: 15R

Elev (ft) : 495 Slope: 0.00

RWY Length (m): 3500 Clearway (m): 60 Stopway (m): 60 Obstacles: 5

LineUp (deg): 180

"Climb on 145 deg. At 1500 turn left to TOE HP. Maintain V2 TKOF flaps to 1500."

**RESULTS**

Perf. Limit Weight (kg): 83894 OPT CONF: CONF 2

OAT (°C)	Weight (kg)	Code	V1 (kt)	VR (kt)	V2 (kt)	EO acc alt (ft)
20	75500	TOW-2SEG	125	135	140	1995

FLEX (°C)	Weight (kg)	Code	V1 (kt)	VR (kt)	V2 (kt)	EO acc alt (ft)
45	75500	TOW-2SEG	125	136	141	1995
47	75500	TOW-TOW	127	138	142	1995
49	75500	TOW-TOW	129	140	145	1995
51	75500	TOW-2SEG	134	142	146	1995
53	74975	2SEG-FTO	137	143	147	1995
55	73702	2SEG-FTO	136	142	146	1995

COMPUTATION <F7>

REMINDER <F9>

Detailed Results <F10>

QUIT <ESC>

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# Weight & Balance



Airbus Industrie - Less Paper Cockpit v 1.0 - Weight & Balance Module

<b>AIRCRAFT</b>		<b>DEPARTURE &lt;F2&gt;</b>		<b>PAYLOAD DISTRIBUTION &lt;F6&gt;</b>		<b>FUEL DISTRIBUTION &lt;F7&gt;</b>	
A/C Type: A340-313 Tail Number: C-FYKX		A/P: CDG		<p>MAX 32      MAX 112      MAX 120</p> <p>OA 1-6 15    OB 7-24 85    OC 27-42 69</p> <p>MAX: 10206    MAX: 20412    MAX: 13878    MAX: 10206    MAX: 3468</p> <p>CP1 5000    CP2 5000    CP3 5000    CP4 1500    CP5 1420</p> <p>MAX FWD: 22861      MAX AFT: 18507</p> <p>Info: Spare Tire in Cpt5: No loading at position 55</p>			
<b>CONFIGURATION &lt;F3&gt;</b>							
Conf. Code: Europe							
Crew: 2/10							
Catering: Type A							
Miscellaneous: Spare Tire in Cpt 5							
DOW: 135370 kg      DOCG: 32.9 %RC							
Direct DOW <ALT F3>							
MTOW (kg): 271000    MLW (kg): 190000							
<b>LOADING &lt;F4&gt;</b>							
PAX	95/24/5/2	To	JFK				
PAX	40/5/0/2	To	MIA				
Cargo (kg):	12400 (11500/20)	To	JFK				
Cargo (kg):	6520	To	MIA				
FOB (kg):	65000						
Fuel Density (kg/l):	0.785						
Trip Fuel (kg):	59000						
Underload: 9995 kg limited by ZFW							
Total PAX: 135/29/5/4		Total Cargo: 18920 kg					
<b>INOP ITEM &lt;F5&gt;</b>							
NORMAL							
<b>RESULTS</b>				<p>Dry Oper. 135370 kg    33.5 %RC</p> <p>Payload 32635 kg</p> <p>Zero Fuel 168005 kg    27.4 %RC</p> <p>FOB 65000 kg</p> <p>Take Off 233005 kg    27.6 %RC</p> <p>Trip Fuel 59000 kg</p> <p>Landing 174005 kg    26.0 %RC</p> <p>THS: 4.9 Up</p> <p>MTOW = 271000 kg</p> <p>MLW = 190000 kg</p> <p>MCFW = 178000 kg</p>			



# Design Principles for Performance Modules

## ● General

- All functions are accessible from the keyboard to avoid the use of the mouse
- Color scheme
  - background/frame/field entry color modifiable
  - Night vision/Day vision switch(Alt -V)

AIRCRAFT	DEPARTURE <F2>
A/C Type: A320-214	A/P: EGLL
Tail Number: F-320A	
CONFIGURATION <F3>	
Conf. Code:	Summer
Crew:	2/5
Catering:	Standard
Miscellaneous:	NONE
DOW: 45945 kg	DOCG: 29.3 %RC
MTOW (kg): 75500	MLW (kg): 64500



# **Design Principles for Performance Modules**

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- **Main Screen**

- Limited number of screens
- All important information readable on the main screen
- Data or information all contained and grouped in “frames”
- Function keys are used to access each frame
- Arrow keys are used to navigate within each frame



# Design Principles for Performance Modules

## (2)

### ● The Frame

- When a function key is pressed, the corresponding frame receives the focus on the first field.
- The focus is clearly marked by a blue arrow between the field label and the field entry. The label is marked with a blue box.
- The field is composed of a label followed by the units used and followed by the entry value.

LOADING <F4>			
PAX:	150/0	To	DES1
Cargo (kg):	200	To	DES1
FOB (kg):	0		
Trip Fuel (kg):	0		
Underload: 2855 kg limited by ZFW			
Total PAX: 150/0		Total Cargo: 200 kg	



# Design Principles for Performance Modules

## (2)

### ● The Frame

- When a function key is pressed, the corresponding frame receives the focus on the first field.
- The focus is clearly marked by a blue arrow between the field label and the field entry. The label is marked with a blue box.
- The field is composed of a label followed by the units used and followed by the entry value.
- A field can be displayed in 3 different ways:
  - No entry is possible, the parameter is written in plain ①
  - The entry is entered by the pilot, the entry area is a box ②
  - The entry is selected from a list of available options, the entry area is a box with an arrow down to indicate a list ③

CONFIGURATION <F3>

Conf. Code:	Summer
Crew:	2/5
Catering:	Standard
Miscellaneous:	NONE
DOW: 45945 kg	DOCG: 29.3 %RC
MTOW (kg): 75500	(kg): 64500



# Design Principles for Performance Modules

(2)

## ● The Frame

- When a function key is pressed, the corresponding frame receives the focus on the first field.
- The focus is clearly marked by a blue arrow between the field label and the field entry. The label is marked with a blue box.
- The field is composed of a label followed by the units used and followed by the entry value.
- A field can be displayed in 3 different ways:
  - No entry is possible, the parameter is written in plain ①
  - The entry is entered by the pilot, the entry area is a box ②
  - The entry is selected from a list of available options, the entry area is a box with an arrow down to indicate a list ③
- The Status Bar offers help to the pilot when a field receives the focus.

Take-off Weight Range: From 35000 to 100000 (kg) .  
Enter Value in kg(lb) or 1000 kg (lb) followed by kg for kilo and lb for pounds.



### ● Protection and Security

- All fields are protected against involuntary modification and this protection is removed by typing the ENTER key.
- When the user changes any input parameter, the result frame is emptied immediately.
- If the pilot entry is converted by the interface (e.g. unit change, ...), the pilot entry is displayed in between brackets after the converted value.

QNH (HPa) :	<input type="text" value="1013"/>
<input type="text" value="TOW (kg) :"/> →	<input type="text" value="54431 (120000 lb)"/>
CONF :	<input type="text" value="OPT CONF"/>
Air Conditioning :	<input type="text" value="Off"/>



# Design Principles for Performance Modules

## (4)

### ● Managing Error Entries

- Errors are managed at 4 different levels:
- Error level A
  - validation of a discrete datum against available range

The screenshot shows a flight simulation interface with several input fields. The 'TOW (kg)' field is highlighted with a blue border and a blue arrow pointing to it. An error dialog box is open in the foreground, displaying a yellow warning triangle icon and the text: 'ERROR! TOW must be from 35000.000 through 100000.000 (kg) . OK'.

QNH (HPa) :	1013
TOW (kg) :	120000
CONF :	OPT CONF
Air Conditioning :	Off
Anti ice :	Off
Runway Condition :	Dry

Take-off Weight Range: From 35000 to 100000 (kg) .  
Enter Value in kg(lb) or 1000 kg (lb) followed by kg for kilo and lb for pounds.





# Design Principles for Performance Modules

(4)

## ● Managing Error Entries

- Errors are managed at 4 different levels:
- Error level A
  - validation of a discrete datum against available range
- Error level A+
  - validation of a datum against other field of the same frame

OAT (°C) :	21
QNH (HPa) :	1013
TOW (kg) :	75500
CONF :	OPT CONF
Air Conditioning :	Off
Anti ice :	Off
Runway Condition :	Dry

Temperature range  
checked against runway  
condition

Enter OAT value From -30.2 to 54.8 (C)  
followed by F for Fahrenheit or C for Celsius.



# Design Principles for Performance Modules

(4)

## ● Managing Error Entries

- Errors are managed at 4 different levels:
- Error level A
  - validation of a discrete datum against available range
- Error level A+
  - validation of a datum against other field of the same frame
- Error level B
  - validation of a datum against other field of the same frame

The screenshot displays a flight performance module interface. In the foreground, an "ERROR!" dialog box with a yellow warning icon and the text "Tail Wind must not exceed 15 kt." is shown, with an "OK" button. Behind it, the "Airport/RWY <F2>" window is visible, showing "LHR EGLL HEATHROW" and "RWY: 09L". Below this, the "CONDITIONS <F3>" window displays input fields for "Wind (° / kt) : 25 (270/25)", "OAT (°C) : 21", "QNH (HPa) : 1013", and "TOW (kg) : 45945". Other fields like "Elev (ft) : 79", "Slope: 0.00", "Clearway (m): 0", "Stopway (m): 0", and "Obstacles: 4" are also visible. A "Modify RWY <ALT-F2>" window is partially visible at the top right.



### ● Managing Error Entries

- Errors are managed at 4 different levels:
- Error level A
  - validation of a discrete datum against available range
- Error level A+
  - validation of a datum against other field of the same frame
- Error level B
  - validation of data of a frame with respect to other frames
- Error level C
  - validation of all data which can only be done by executing a separate computation.

**For example: Loading distribution outside CG envelope**



# Design Principles for Performance Modules

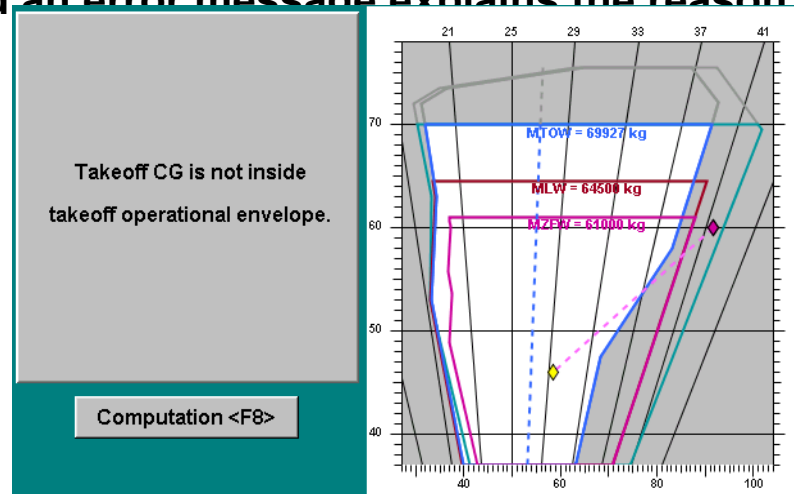
(5)

## ● Display of Results

- Differentiation of useable results from unusable ones.
- Unusable results are either:
  - displayed in Magenta/Red when the maximum permissible takeoff weight is lower than the actual weight

RESULTS						
Perf. Limit Weight (kg): 69927						
OAT (°C)	Weight (kg)	Code	V1 (kt)	VR (kt)	V2 (kt)	EO acc alt (ft)
30	69927	OBS-OBS	140	145	146	1579

- not provided and an error message explains the reason of the failure

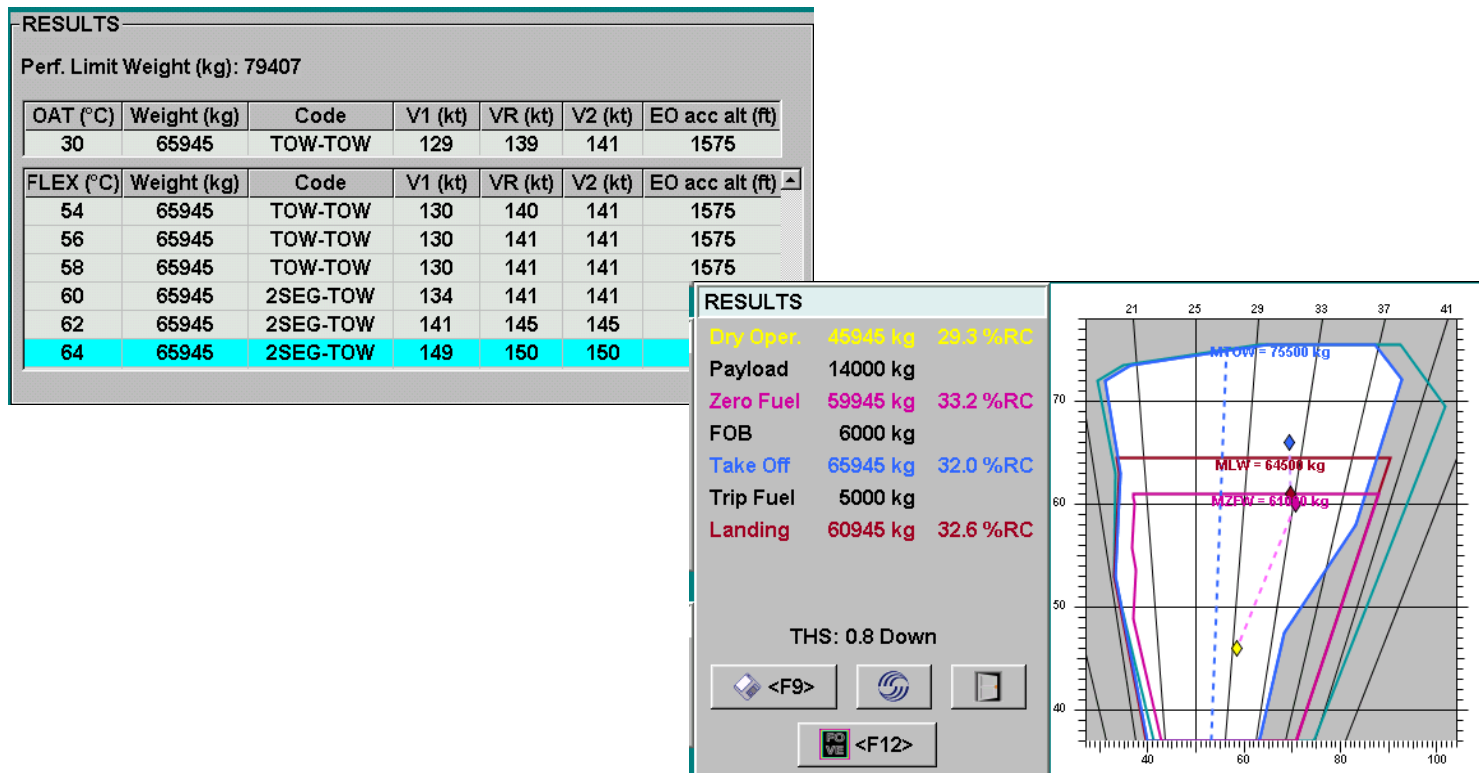




# Design Principles for Performance Modules (5)

## ● Display of Results

- Differentiation of useable results from unusable ones.
- Usable results are displayed in numerical and graphical format (when applicable)



# Coming Soon

Landing

Airbus Industrie - Less Paper Cockpit - LANDING PERFORMANCE

IRCRAFT

A/C Type : A330-223  
Tail Number : F-ZZQQ

CONDITIONS Dispatch <F3> CONDITIONS In-Flight <Alt-F3>

Wind (°/kt) : 0  
OAT (°C) : 25  
QNH (hPa) : 980

MLW struct (kg) : 190000  
LDG Conf : CONF 3

APP C

Air Conditioni  
Anti I  
RWY Condi

Center of Gravity : Forward  
Engine Option : TOGA  
APP Climb Grad : Normal  
APP Type : Normal  
LDG Technique : Manual

ABNORMAL / EMERGENCY CONFIGURATION <F5>  
- NORMAL -

copyright

Airport/RWY <F2> Modify RWY <Alt-F2>

TLS LFBD TOULOUSE-BLAGNAC RWY: 33R  
Elev (ft) : 485 Slope : 0.00  
Available Landing Distance (m) : 3300

In Flight



AIRBUS INDUSTRIE

MEL / OEB

Green Brake System

LIST OF EFFECTIVITIES

32 LANDING GEAR  
32-42 NORMAL BRAKING  
42-02 Green Brake System

In basket

Repair Interval	Nbre Installed	Nbre Required	Ops Procedure	Maintenance Procedure	Airline Document
C	1	1			

Braking on one wheel per landing gear may be inoperative provided :

1. Green hydraulic supply of affected brake is deactivated, and
2. Tachometers associated with operative brakes are operative, and
3. Flight Manual performance penalties are applied.

Display: Path Time

Display Exam Mode: ATA Alphabetic

(SELECTIONS)

[Dispatch Condition]  
01-32-42-02 Green Brake System  
[Exam Warning]  
008 AUTO BRK FAULT

# Coming Soon - Landing module

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- **Dispatch Condition**

- Required Landing Distance
- Approach climb limiting climb

- **In-Flight Condition**

- Normal or in-flight failure affecting approach/landing performance
- Actual landing distance
  - Dry, Wet, contaminated runway
  - With/without Autobrake
  - with/without Autoland
- Approach climb limiting weight
- Calculation of VAPP in case of in-flight failure

# Coming soon - In-Flight module

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- **A complement to the FMS performance computations**
  - Maximum & Optimum altitudes,
  - Climb performance
  - Cruise performance
  - Descent performance
  - Holding performance,
  - Engine-out gross flight path descent trajectory (drift down),
  - Wind altitude trade (optimum FL determination),
  - In-Cruise quick check for abnormal cases (landing gears or airbrakes extended, deviation from CDL, ...)
- **Tabular or graphical presentation of results**



# Sample External Application - Route Manual



**eRM - Revision 200110 - 05 MAR 01 - [CURRENT] - K2**

Print Options Back Forward Go To Contents Routes AD Favorites Previous Next Locate Top Bottom Fit Page Zoom

Help

**Aerodromes**

ICAO	IATA	Name
LEST	SCQ	SANTIAGO
LEVX	VLC	VALENCIA/MANISES
LEVD	VLL	VALLADOLID/MILLANUBLA
LEVT	VIT	VITORIA/FORONDA
LEVX	VGO	VIGO
LEXJ	SDR	SANTANDER
LEZG	ZAZ	ZARAGOZA
LEZL	SVQ	SEVILLA/SAN PABLO
LFBD	BOD	BORDEAUX/MERIGNAC
LFBH	LRH	LA ROCHELLE/ILE DE RE
LFBI	PIS	POITIERS/BIARD
LFBL	LIG	LIMOGES/BELLEGRADE
LFBO	TLS	TOULOUSE/BLAGNAC
LFBP	PUF	PAU/PYRENEES
LFBT	LDE	TARBES/LOURDES PYREN...
LFBR	RID	BIARRITZ/MAYONNE & NGI

☐ SID RWY 15L/R  
☐ SID RWY 33L/R  
☐ STAR RWY 15L/R  
☐ STAR RWY 33L/R  
☐ ILS-15R  
☐ ILS-33L  
☐ ILS-15L  
☐ ILS-33R  
☐ VOR-15L (VOR/DME)  
☐ VOR-15R (VOR/DME)  
☐ VOR-33L (VOR/DME)  
☐ VOR-33R (VOR/DME)  
☒ LC  
☐ GAD  
☐ ADP

**Toulouse-Montaudou**

RWY	QFU	APL	THL	RWL	SLOPE	Notes
15R	145	H-B	H	H	0	Macadam
33L	325	-	H	H	0	PAPI 3.00L
15L	145	H-C	H	H	0	870M
33R	325	-	H	H	0	REIL
						Edge lights white

0 500 1000

Ready N 74°0.6' W 118° 28.7' 09 MAR 01 12:47 UTC

# Conclusion

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- **Presently 45 airlines are using at least one module of the LPC.**
- **10 % of yearly increase is expected.**
- **LPC is the first application brick paving the way for AFIS (Airbus in-Flight Information Services) and A380**
- **Future developments should privilege:**
  - **The context based access to the information**
  - **One-way interactivity with aircraft systems between cockpit systems and LPC**
  - **New technologies capabilities (intelligent graphics,audio,video...)**
  - **Level of interactivity with FMS (One-way or 2-way ?)**